

I claim:

1. A direct contact steam injection heater comprising:

a heater body having a steam inlet, a flowing stock inlet and a heated stock discharge outlet, the flowing stock inlet and the heated stock discharge outlet being aligned such that the flowing stock flows through the heater body generally in an axial direction;

a diffuser tube mounted transverse to the axial direction of stock flow through the heater body, the diffuser tube having a cylindrical outer wall having a plurality of steam diffusion holes, the diffuser tube being arranged to receive the flow of steam and discharge the steam through the diffusion holes into the flowing stock;

an adjustably positionable steam-plug cover positioned within the diffuser tube, the steam-plug cover having a cylindrical outer wall defining an open interior that receives a flow of steam, the outer wall having at least one open slot that enables steam to flow out of the open interior; and

a resilient seal member surrounding the open slot formed in the steam-plug cover, wherein the seal member contacts an inner wall of the diffuser tube to provide a seal between the inner wall of the diffuser tube and the steam-plug cover surrounding the open slot.

2. The direct contact steam injection heater of claim 1 wherein the steam-plug cover includes a pair of open slots, each open slot being surrounded by a seal member.

3. The direct contact steam injection heater of claim 2 wherein the seal member is a resilient O-ring.

4. The direct contact steam injection heater of claim 3 wherein each O-ring is received in a recessed slot formed in the steam-plug cover surrounding the open slot.

5. The direct contact steam injection heater of claim 2 wherein each of the open slots formed in the steam-plug cover occupies less than one quarter of the circumference of the steam-plug cover.

6. The direct contact steam injection heater of claim 5 wherein the steam-plug cover is adjustably positionable between a fully closed position in which no steam diffuser holes are aligned with the open slots to a fully open position where a maximum number of steam diffusion holes are aligned with the open slots.

7. The direct contact steam injection heater of claim 6 wherein the steam diffusion holes are positioned between the pair of O-rings when the steam-plug cover is in the fully closed position.

8. The direct contact steam injection heater of claim 1 further comprising a deflector placed upstream of the diffuser tube to redirect the flow of stock through the heater body toward the steam diffusion holes.

9. The direct contact steam injection heater of claim 8 wherein the deflector is removably mounted to opposing inside surfaces of the heater body.

10. The direct contact steam injection heater of claim 1 wherein the steam-plug cover includes at least one pressure port extending through the outer wall and in communication with a driving assembly to equalize the pressure within the open interior of the steam-plug cover and the driving assembly.

11. The direct contact steam injection heater of claim 1 wherein the diffuser tube includes a wear coating applied to an outer surface of the cylindrical outer wall.

12. The direct contact steam injection heater of claim 11 wherein the wear coating is formed from tungsten carbide.

13. The direct contact steam injection heater of claim 9 wherein the deflector includes a wear coating applied to an outer surface of the deflector.

14. The direct contact steam injection heater of claim 13 wherein the wear coating is formed from tungsten carbide.

15. A direct contact steam injection heater comprising:

a heater body having a steam inlet, a flowing stock inlet and a heated stock discharge outlet, the flowing stock inlet and the heated stock discharge outlet being aligned so that the flowing stock flows through the heater body generally in an axial direction;

a diffuser tube mounted transverse to the axial direction the stock flows through the heater body, the diffuser tube including a cylindrical outer wall having a plurality of steam diffusion holes, the diffuser tube being arranged to receive a flow of steam and discharge the steam through the diffusion holes into the stock, the diffuser tube including a wear coating formed on an outer surface of the cylindrical outer wall;

an adjustably positionable steam-plug cover positioned within the diffuser tube, the steam-plug cover having a cylindrical outer wall defining an open interior that receives a flow of steam, the outer wall having at least one open slot that enables steam to flow out of the open interior; and

a deflector plate positioned upstream of the diffuser tube to redirect the flow of stock through the heater body toward the steam diffuser holes, the deflector including a wear coating formed along an outer surface.

16. The direct contact steam injection heater of claim 15 wherein the wear coating formed on the diffuser tube and the deflector plate is formed from tungsten carbide.

17. The direct contact steam injection heater of claim 15 further comprising a resilient seal member surrounding the open slot formed in the steam-plug cover,

wherein the seal member contacts an inner wall of the diffuser tube to provide a seal around the open slot.

18. The direct contact steam injection heater of claim 17 wherein the steam-plug cover includes a pair of open slots, each open slot being surrounded by a seal member.

19. The direct contact steam injection heater of claim 18 wherein each of the open slots formed in the steam-plug cover occupies less than one quarter of the circumference of the steam-plug cover.

20. The direct contact steam injection heater of claim 19 wherein the steam-plug cover is adjustably positionable between a fully closed position in which no steam diffuser holes are aligned with the open slots to a fully open position where a maximum number of steam diffusion holes are aligned with the open slots.

21. The direct contact steam injection heater of claim 20 wherein the steam diffuser holes are positioned between the pair of seal members when the steam-plug cover is in the fully closed position.

22. The direct contact steam injection heater of claim 15 wherein the steam-plug cover includes at least one pressure port extending through the outer wall and in communication with a driving assembly to equalize the pressure within the open interior of the steam-plug cover and the driving assembly.